“Studies on Detection and Management of Pesticide Residues of Fruit Vegetables from Nanded district of Marathwada.”

A

Synopsis submitted to

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INTRODUCTION:

The world human population reached 8.0 billion in Nov 2022. The demand of food all over the world is increasing as the world population is rapidly increasing because of which there is extreme need of agricultural productivity. Due to diverse topography and different climatic conditions in different states of India, we can see almost all the varieties of fruits and vegetables throughout the year. India ranks second in the world in fruits and vegetable production after China, producing about 12% of the world fruit and vegetable production. India produced 204.61 million metric tonnes of vegetables and 107.10 million metrics of fruits during 2021-22. In recent years, production and export of Indian fruits and vegetables have been increased. (IBEF, 2022).

Vegetables are the necessary source in diet as they provide different kinds of essential nutrients to human body like high concentrations of vitamins, dietary fiber, folate, potassium, etc. Vegetables also contain antioxidants and phytochemicals as these biologically active substances can help to protect humans from some chronic diseases and keep them healthy. (Dhandevi PEM and Rajesh JEEWON, 2015). It is necessary to satisfy increasing demand of food so the farmers started using chemical pesticides to increase the crop productivity.

According to FAO (Food and Agricultural Organisation) Pesticides are any chemical or biological substances or mixture of substances intended for repelling, destroying or controlling any pest for regulating plant growth. The term pesticide applies to insecticides, herbicides, fungicides, rodenticides, molluscicides, wood preservatives. Pesticides also include plant growth regulators, defoliants and desiccants. Pesticides are widely used both before and after harvesting the crop yield to secure crop yield and to decrease crop loss. There is an increasing awareness in many countries about pesticide residues and inadequate monitoring of imported foods and plant products. (Gowda, Ananda S R, 2013). From the total of about 13 to 14 % of pesticides are used for the production of fruits and vegetables in India covering only 3% of the cropped area of agriculture.

Pesticides are of many types such as carbamic and thiocarbamic derivatives, carboxylic acids and their derivatives, organochlorines (endosulfan, hexachlorobenzene), organophosphates (diazinon, omethoate, glyphosate), phenol and nitro phenol derivatives, hydrocarbons, ketones, aldehydes and their derivatives, urea derivatives, copper-containing compounds, heterocyclic compounds (benzimidazole and triazole derivatives), fluorine containing compounds, metal organic and inorganic compounds, and natural and synthetic pyrethroids. In India, pesticides used for fruits, vegetables and food grains include many pesticides like butachlor, carbendazim, chlorpyrifos, copper oxychloride, cypermethrin, dichlorvos, endosulfan, isoproturon, malathion, mancozeb, methyl parathion, monocrotophos, quinalphos and sulphur. (Ajmer Singh Grewal *et.al.,* 2017).

Farmers have relied on pesticides which are used to kill or avoid the pests of crops such as insects, fungus, bacteria, etc. Pesticides due to their toxic properties, persistent nature and bioaccumulation can cause health problems in humans and animals. On other hand, overuse of pesticides causes soil pollution which can lead to infertile soil. (Chau Nguyen Dang Giang *et.al.*, 2022). Due to consumption of contaminated fruits and vegetables by pesticides, the major health problems can cause. Acute effects like diarrhoea, dizziness, rashes, etc. and chronic health impacts like birth defects, cancers, endocrine disruptors, neurological disorders and reproductive effects. (Nikhat Khan *et.al*., 2020). This is the reason why quantification of pesticide and biocontrol of crops are becoming a public interest.

Physical control, chemical control and biological control are the major methods of pest control. The control of one organism by another organism is known as biological control. In the era of modern biological control, the records of its safety in past years are the reason of its growing popularity. Biopesticides are not only control the disease but also enhance the plant growth due to increase in beneficial soil microflora which again results into increase in the crop yield. (Anchal Sharma *et.al*.,2013).

On the other hand, chemical pesticides can reduce the concentration of essential plant nutrients like nitrogen and phosphorus. Chemical pesticides can cause soil pollution by affecting beneficial insect species, worms, microorganisms responsible for soil health, and also affect beneficial insect species and soil quality. Chemical nutrients can also reduce concentration of essential plant nutrients like nitrogen and phosphorus. Biocontrol agents are harmless to humans and environment. Biopesticides helps to provide protection of biodiversity and restore natural ecosystem. (Leonard Holmes *et.al.,* 2016). Biopesticides are the best alternative of chemical pesticides and due to increasing awareness in the society about pesticide residues is the reason for scientists for doing research on biopesticides which is the best alternative to chemical pesticides.

❖ REVIEW OF LITERATURE:

Baker and Cook (1974) documented that the discovery of biological control is the trial-and-error method that has practiced in agriculture long time before the term itself exists. Some plants may have negative effects which emits repellent chemical substances on pests which indirectly benefits the crop plants. Das (1995) reported some plants called secondary plants as many plants synthesize natural substances like alkaloids, terpenoids, flavonoids, quinones, etc. in their different plant parts like roots, flowers, stems, or leaves, which can either repel or attract insects. These chemicals can be effective in

controlling many insect pests and diseases. Hja¨lte`n *et.al.*, (1993) termed a repellent plant as a plant which is generally used to keep pest organisms away from the crop plants.

Baker (1987) stated that the German plant pathologist C. F.von Tubuef (1914) wrote the first reference in the scientific literature to the term "biological control" in an article named "Biologische Bekampfung von Pilzkrankheiten der Pflanzen" in German language. The era of biological control for the introduction of natural control of insect pests, was began 100 years ago to control the cottony cushion scale of citrus with the highly successful introduction of the vadalia beetle from Australia to California in 1888.

Nawaz *et.al.,* (2016) stated that the current research of biopesticides mainly focusing on the improvement of their action spectra that is mechanisms to replace the use of chemical pesticides in Integrated Pest Management (IPM) plans. Mazid *et.al.,* (2011) documented biopesticides derived from plants such as *Chrysanthemum indicum*, *Azadirachta indica* (Neem), *Curcuma longa* (Turmeric), etc. from animals (e.g., nematodes), from microorganisms (e.g., *Bacillus thuringiensis*, *Trichoderma, Pseudomonas*), and include living organisms (natural enemies), their product (phytochemicals, microbial products) which can be used for the pest management.

Dar *et.al.,* (2004) estimated the annual growth rate of biopesticide is 2.5% in India. National Farmer Policy 2007 has promoted the utilization of biopesticides for sustainable farming. The biopesticide production is relatively lower in India due to some issues at the policy and industrial level. The consumption of plant-derived biopesticides is less than 1% in India and is only 12% globally. Muthomi J.W., *et.al.,* (2018) stated that biopesticides are playing a vital role in the agro-market and are widely utilised in organic farming in these days. Ecobichon, D.J. (2001) documented that contribution of pesticide industry to the economy is tremendous in tropical regions and even in other developing countries.

Ramesh H.L. (2013) stated that as the majority of Indians are vegetarians, vegetables are the major component of diet in India. Indian agriculture is tradition oriented and pest management is still a built-in process. Pest damage severely affects production of vegetables and fruits in India. To improve quality, increase yield, and extend the storage life of food crops, pesticides are widely used in agriculture. Though, chemical pesticides like DDT and BHC are banned commercially still these two chemicals are mostly used in agriculture in India. These chemicals are very much in use due to ready availability at wide spectrum of activity and low cost. As chemical pesticides are harmful and can cause many diseases to human health, the best alternative to chemical pesticides can be biopesticides. To maintain the quality and abundance of crops, plant diseases need to be controlled by using biopesticides.

❖ OBJECTIVES OF THE STUDY:

- Collection, extraction and quantification of pesticide residue of selected fruit vegetables by washing (household) system.
- Extraction of pesticide residues from fruit vegetables by different solvent system.
- Estimation of pesticide residues from fruit vegetables by using GC/MS technique.
- To study phytochemical screening of selected species.
- To study antimicrobial activity of selected species.
- To study pest management by using botanicals to control pests and diseases on fruit vegetables.
- Statistical study of all approaches.

❖ MATERIAL AND METHODS:

1. Collection of selected fruit vegetables from local market.

   Expected list of fruit vegetables for the study:

	Samples	
Sr. No.	**Botanical name**	**Common Name**
1.	*Abelmoschus esculents*	Okra
2.	*Luffa acutangula*	Ridged gourd
3.	*Momordica charantia*	Bitter melon
4.	*Solanum melongena*	Brinjal
5.	*Solanum lycopersicum*	Tomato

2. Cleaning of fruit vegetables by different methods.
3. Pesticide residue analysis of selected fruit vegetables by GC-MS method.
4. Collection of plant samples for pest management from local area.
5. Extraction of plant samples will be done.
6. Phytochemical analysis of plant samples will be carried out.
7. Antibacterial and antifungal activity of plant samples will be performed by using *Lantana camara.*
8. Biological pest management.

❖ IMPORTANCE OF THE STUDY:

- **NATIONAL STATUS:**

Agriculture is adversely affected by various pesticides such as insecticides, fungicides, herbicides, etc. India became self-sufficient in wheat production in the first wave of green revolution in the late 1970s. In the second wave of green revolution, almost all the crops including rice production enhanced rural income. Most common pest control has been the extensive use of chemical pesticides from about past 50 years. In India, under the Insecticide Act, 1968, biopesticides are registered and regulated in which only 12 types of biopesticides have been registered. Under this Act. 2.5% is the estimated annual growth rate of biopesticides in India. In India, the annual chemical and synthetic pesticide consumption is 381 g/ha whereas the rate of pesticide consumption is rising from 2 to 5% yearly. India has shown a drastic increase in biopesticide consumption over the time which stood at 8847 and 8645 metric tonnes in 2019-20 & 2020-2021, respectively. (Rajni Yadav, *et.al.,* 2022).

Biopesticides has not been used efficiently by the farmers due to the lack of information regarding the commercial use of biopesticides. So, in order to understand the concept of biological control at university level in this direction needs to be enhanced. (Jan Mohd Junaid, *et.al.,* 2013). Major government agencies involved in commercial production of different biopesticides are central and state agricultural universities and various ICAR institutes. In India, most of the biopesticide production takes place in public sector units which contributes to almost 70% of the total biopesticides production. However, in last few decades in India, the consumption of biopesticides has increased. (Jitendra Mishra, *et.al.,* 2020).

- **INTERNATIONAL STATUS:**

The estimated value of global pesticide market is USD 5.5 billion in 2022 which is projected to reach USD 11.3 billion by 2027. (Biopesticides global market report 2023). The total production of pesticides is 3000 tonnes per year and their use is increasing steadily by 10% every year. The annual growth rate of biopesticides will be up to 8.64% which account for about 7% ($4.5 billion) of the worldwide crop protection market till 2023. (Rajni Yadav, *et.al.,* 2022).

The global organization named: The International Organization for Biological Control' (IOBC) is dedicated to the promotion of methods of insect, weed and disease control which are environmentally safe. IOBC was established in 1955. The organization promotes training of personnel, national and international research, coordination of large-scale application and public awareness of the social and economic need of biological control. (B. I. P. Barratt, *et.al.*, 2018).

The demand of biopesticide is increasing day by day all over the world. The current estimated US biopesticide market is USD 205 million and the predicted increase till the end of the decade is nearly USD 300 million. Approximately 40% of the world's biopesticide production is consumed by North America. The expected biopesticide market in 2005 was predicted to be worth over USD 135

million which then reached approximately USD 270 million by 2010. Whereas 20% of global biopesticide sales is by Oceanic and European countries. The predicted biopesticide sales are expanding in South and Latin America, which together account for 10% of the global biopesticide market. While Asian biopesticide market presents a significant opportunity for biopesticides. (Nilanjan Chakraborty, *et.al.,* 2023).

❖ SIGNIFICANCE OF THE STUDY:

Advantages of biopesticides like environmental safety, target-specificity, efficacy, biodegradability and suitability in the integrated pest management (IPM) programs are the reason of interest. Biopesticides as safer tool to control pest population attracting global attention. The adoption of biopesticides by the farmers is increased. In the developing countries, the need of the day is a public-private sector approach to the development, manufacturing and sale of environment friendly alternatives to chemical pesticides. The biopesticide science is considered to be still new and evolving. In many areas, research is needed to be done such as production, formulation, delivery and commercialization of the products. Currently, some of the biopesticides are excellent alternatives of chemical pesticides are under development. (Suresh Kumar, et.al., 2015).

There are some factors that promotes the biopesticides market such as awareness amongst users, easy availability, low-cost product, better delivery system, consistence field performance, broad activity spectra, long shelf life, reframing registrations and regulation policies. As biopesticides are eco safe, it is a need to encourage and empower developing countries to develop their biopesticide manufacture and use in the field for safer environment. (Rajni Yadav, *et.al.,* 2022).

❖ PLAN OF WORK:

	Parameters
First year	1. Review of literature
	2. Collection of fruit material from different localities.
	3. Preparation of plant material for laboratory work.
Second year	1. Quantification of pesticide residue by GC-MS method
	2. Study of phytochemical screening of selected species
	3. Study of antimicrobial activity of selected species
Third year	1. Study of pest management by using botanicals.
	2. Preparation of research papers and articles
	3. Writing and submission of thesis

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